July 2002

Grand Junction Office

Perspective

Spotlight on UMTRA Ground Water Project

Volume 10

GJO Prepares for Busy Summer

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DOE–GJO Manager

By the time you read this, the U.S. Department of Energy Grand Junction Office (DOE–GJO) will have a new Technical Assistance Contract contractor. S.M. Stoller Corporation of Lafayette, Colorado, was awarded the contract for DOE–GJO. Two companies, MACTEC Environmental Restoration Services (MACTEC–ERS) and *WASTREN, Inc.*, served as the Technical Assistance and Remediation contractor and the Facility Operations and Support contractor, respectively, from September 5, 1996, to July 21, 2002. I want to thank MACTEC–ERS and *WASTREN* for their excellent support to DOE–GJO during the last 6 years and congratulate Stoller on this award. We look forward to our association with Stoller during the coming years.

Waste Management 2002

At the Waste Management Symposium 2002, DOE–GJO was proud to receive an honorable mention award for its oral paper presentation on lessons learned during the transition of the DOE–GJO site to private ownership. Tracy Plessinger and I wrote the paper, which was presented at Waste Management 2001. Oral paper presentations were evaluated by session attendees, session chairs, and symposium organizers on the basis of the technical quality

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Inside This Issue

This issue of the Grand Junction Office Perspective *focuses on activities at Uranium Mill Tailings Remedial Action (UMTRA) Ground Water Project sites. The cover (clockwise from top) features the former millsite at Gunnison, Colorado; columns containing zero-valent iron at the New Rifle, Colorado, site; drilling operations at the Tuba City, Arizona, site; stakeholders touring the Tuba City site; the building used for prototype tests at the New Rifle site; and the distillation unit at the Tuba City site.*

You can visit the GJO website at gjo.doe.gov

Grand Junction Office Perspective

The ***Grand Junction Office Perspective*** is published by the U.S. Department of Energy Grand Junction Office, 2597 B¾ Road, Grand Junction, Colorado.

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Tuba City, Arizona, Distillation Unit in Operation

On March 15, 2002, the full-scale distillation system at the Tuba City, Arizona, Uranium Mill Tailings Remedial Action (UMTRA) Ground Water Project site became operational.

Groundwater at the Tuba City site is contaminated with residual radioactive material as a result of historical processing of uranium ore. Four contaminants detected in the groundwater (molybdenum, nitrate, selenium, and uranium) are present in concentrations that exceed maximum allowable limits. The U.S. Department of Energy Grand Junction Office (DOE–GJO) selected active remediation as the groundwater compliance strategy at the Tuba City site. DOE will clean up the groundwater by extracting it from the aquifer, treating it with a distillation system, and injecting the treated water back into the aquifer.

In fall 1998, DOE–GJO conducted pilot tests of two alternative distillation systems. As a result of these tests, DOE–GJO contracted with U.S. Filter Corporation to supply the full-scale treatment system for Tuba City. The U.S. Filter process uses an evaporator designed and manufactured by Hadwaco Ltd. Oy of Helsinki, Finland. Pilot test results indicated a low rate of fouling, the process by which the heat-transfer surfaces become coated with scale because of deposition of calcium sulfate on the evaporator walls. However, rates of calcium sulfate deposition observed during operation of the full-scale unit in spring and summer 2000 were much higher than those in the pilot tests and precluded successful continuous operation of the treatment unit.

A distillation unit is the treatment system for contaminated groundwater at the UMTRA Ground Water Project site at Tuba City, Arizona.

Ion-Exchange System Added

The treatment unit was put on hold while an additional series of pilot tests was conducted at the site between November 2000 and August 2001. These tests successfully identified the causal factors contributing to the high fouling rates but also established that significant modifications, requiring a lengthy development and demonstration program, would be required to alleviate the fouling. To get the treatment system online quickly, DOE–GJO and U.S. Filter jointly agreed to install an ion-exchange pretreatment system to remove calcium and magnesium from the groundwater before treatment with the distillation system to prevent the formation of scale.

“Initial results of the Tuba City treatment system incorporating the ion-exchange pretreatment system have been encouraging,” said Don Metzler, DOE–GJO UMTRA Ground Water Project Manager. “Operation has been nearly continuous, at production rates exceeding the design rating of the treatment system.” No fouling of the evaporator has been observed. Consumption of salt (used to regenerate the ion-exchange unit) has been lower than anticipated, and the impact on the energy

consumption of the treatment unit that is due to addition of the ion-exchange equipment has been minimal. DOE–GJO has contracted with Hadwaco to undertake the development and demonstration program that will be necessary to identify and verify the modifications that will permit the elimination of the ion-exchange unit.

Treatment Capabilities

The treatment system currently produces as much as 100 gallons per minute, which is more than 1 million gallons per week, of distillate-quality water. The treated water is returned to the aquifer. The treatment system also generates 15 to 20 gallons per minute of wastewater that is pumped to a solar evaporation pond constructed at the site. The evaporation capacity of the solar pond will be increased by addition of a spray system expected to be operational by fall 2002. The analytical capabilities of the Tuba City site have been expanded by construction of an enlarged on-site laboratory and shop.

Because the site is within the boundaries of the Navajo Nation and is close to the Hopi Reservation, the Native Americans in these areas are important stakeholders to the Tuba City site. DOE–GJO held a meeting in March with representatives of the Navajo Nation and Hopi Tribe to inform them of the schedule of activities. DOE–GJO has also made preliminary plans to host an open house at the site in October 2002 for the public to tour the facility.

Phase Two of Project

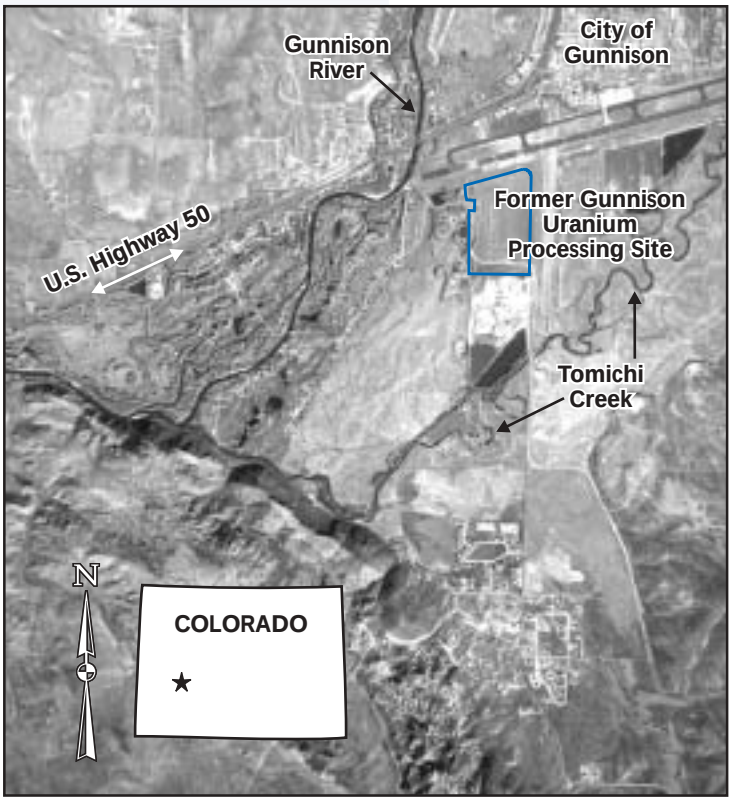
The treatment system is planned to operate for 20 years, at which time concentrations of contaminants should meet U.S. Environmental Protection Agency standards and, to the extent practicable, will be within the cleanup goals requested by the Navajo Nation. Monitoring and modeling results will be used to design phase two of the project, which may involve the installation of 40 to 55 additional extraction wells, 20 to 30 additional injection wells, and an additional treatment process in 2 to 4 years. “Before a final decision is made regarding phase two, DOE would like to use the observational approach to better understand how the contaminated aquifer is responding to phase one remedial action,” said Metzler. “DOE wants to be confident that the model predictions and the aquifer response are synchronized.”

At the completion of groundwater cleanup, DOE will remove the distillation treatment unit(s), water storage tank, evaporation pond, existing ponds, and infiltration trench. A limited number of injection and extraction wells will be left in place for use as long-term groundwater monitor wells.

For more information about the Tuba City UMTRA Ground Water Project site, contact Don Metzler, DOE–GJO Project Manager, at (970) 248–7612.❖

Mother Nature: A Groundwater Solution

"Just good old-fashioned dilution" were the words used by Don Metzler to describe the groundwater compliance strategy of natural flushing to a consortium of government officials and local residents at a public meeting held in Gunnison, Colorado, on March 5, 2002. Metzler is the U.S. Department of Energy Grand Junction Office (DOE–GJO) Project Manager responsible for the Uranium Mill Tailings Remedial Action (UMTRA) Ground Water Project. He led a discussion on the status of the Gunnison Ground Water Project site at the meeting.



The former Gunnison uranium-ore processing site is located southwest of the City of Gunnison and adjacent to the Gunnison County Airport.

Millsite History

The Gunnison site is a former uranium-ore processing site located on a 61.5-acre tract of land between the Gunnison River and Tomichi Creek, just southwest of the Gunnison city limits. Uranium ore from the Cochetopa Pass area was processed at the Gunnison mill from 1958 to 1962. During its 4-year lifetime, the mill processed approximately 540,000 dry tons of ore that averaged 0.14-percent uranium oxide.

From 1992 to 1995, the uranium mill tailings and other contaminated materials were removed from the millsite and stabilized in a disposal cell 6 miles east of Gunnison. Groundwater beneath the former millsite was contaminated by uranium processing activities. Uranium and manganese are the constituents of concern in the groundwater.

Public Meeting

Metzler makes it a point to openly discuss with the affected community the kind of contamination that is in the groundwater, what effects that may have on the public health and environment, and what protective measures DOE deems necessary. "Good communication is essential for making the situation a win-win for both parties," said Metzler.

At the Gunnison public meeting, Metzler explained the geological configuration of the contaminated aquifer, displayed cross-sectional drawings and figures showing the extent of contamination, and discussed the three options for bringing the groundwater contamination into compliance: (1) no action; (2) passive remediation, in this case natural flushing; and (3) active remediation (e.g., pump and treat).

The option of no action is not acceptable at the Gunnison site because the groundwater contamination exceeds U.S. Environmental Protection Agency standards and

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New Groundwater Compliance Strategy Proposed for Vanadium at New Rifle, Colorado, Site Based on Pilot Study Results

Last November, the U.S. Department of Energy Grand Junction Office (DOE–GJO) concluded a pilot study at a former uranium- and vanadium-processing site located west of Rifle, Colorado (the New Rifle site), one of the sites in the Uranium Mill Tailings Remedial Action (UMTRA) Ground Water Project that is managed by DOE–GJO.

Vanadium Pilot Study

The pilot study investigated the feasibility of extracting and treating groundwater to reduce vanadium concentrations in the alluvial (shallow) aquifer to levels that will naturally flush within the 100-year period allowable by Uranium Mill Tailings Radiation Control Act standards (Title 40 *U.S. Code of Federal Regulations* Part 192). A zero-valent iron (ZVI) ex situ process was used to treat the extracted groundwater.

Former activities at the New Rifle site contaminated the alluvial groundwater system directly beneath and hydraulically downgradient of the site. Groundwater modeling has demonstrated that vanadium will probably not reach its risk-based concentration in 100 years. In addition, some soils at the site contain highly elevated concentrations of vanadium and may serve as a continuing source of groundwater contamination.

A prototype test, consisting of laboratory treatability studies followed by bench-scale field tests, provided performance data and design parameters required to scale up to higher flow rates for groundwater remediation. Results of the prototype tests provided the basis for the design of a pilot system capable of treating as many as 20 gallons per minute.

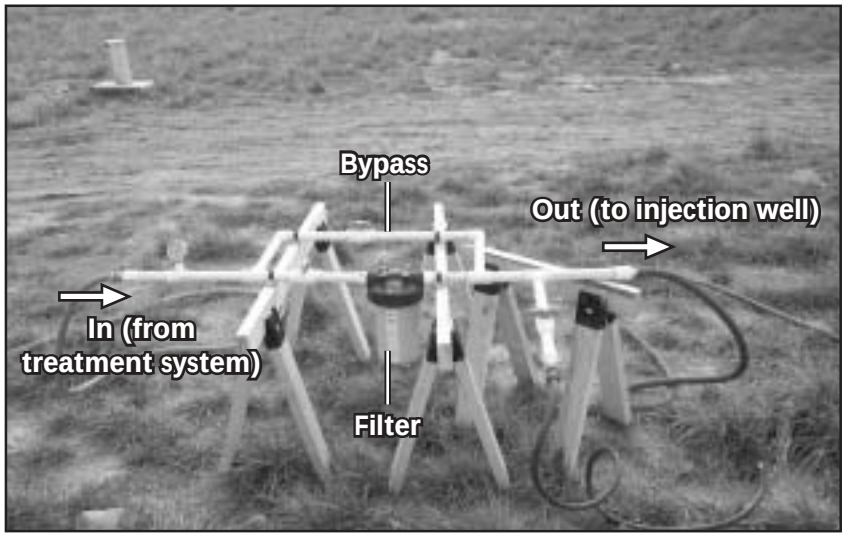
Pilot System Components

The pilot system consisted of three components: an extraction system, a treatment system, and an infiltration system. Three extraction wells were drilled to meet the revised objective of extracting a total of 2 million gallons of groundwater in 8 months from the contaminated plume. Contaminated groundwater was piped to an aboveground ZVI system for treatment. The treatment process consisted of flowing extracted groundwater through a reactor column containing ZVI, then removing the iron from the effluent in a series of downstream settling tanks before returning the treated water to the aquifer at a hydraulically downgradient location via the infiltration gallery.

Evaluation of the pilot pump-and-treat system considered both aquifer performance (pump) and treatment performance (treat). Aquifer performance relates to hydrogeologic characteristics that can affect the quantities and rates that groundwater can be extracted or injected and geochemical characteristics, such as mobility of contaminants in the subsurface, that may limit extraction of the contaminant from the aquifer matrix (i.e., the ability to meet aquifer cleanup goals). Hydraulic parameters of the aquifer, such as permeability and conductivity, did not limit the amount of water or rate that water was extracted from the aquifer. The contaminated water was removed and the treated water was re-injected at rates as planned.

Study Results

Reduction of the vanadium in the aquifer to acceptable levels appears to be limited by the geochemical characteristics of vanadium. "The retardation rate of the vanadium makes it difficult to remove from the aquifer," said Ken Karp, New Rifle Project Manager for DOE–GJO contractor MACTEC Environmental Restoration Services. Contrary to the anticipated effect, no discernable decrease in the concentration of vanadium entering the treatment system could be detected after pumping 2 million gallons of water from the aquifer.



Treated water that exits the zero-valent iron ex situ process is reinjected into the aquifer through injection wells.

Treatment performance of the pilot system relates to the adequacy and operation of the technology, the ZVI treatment column, to meet the chemical cleanup goals for the extracted groundwater cost effectively, in this case removing the vanadium to meet regulatory levels (i.e., treatment goals). The treatment system was operated to meet the following goals in the effluent water before discharge to the aquifer: maintain a pH value of greater than 6 and less than 9, have an iron concentration of less than 11 milligrams per liter, and reduce the vanadium concentration to less than 0.33 milligram per liter. These three chemical cleanup goals for the extracted groundwater were met.

Vanadium Compliance Strategy Using an Alternate Concentration Limit

Because the vanadium concentrations in the aquifer could not be significantly reduced due to its immobility, DOE–GJO reevaluated the compliance strategy for vanadium at the New Rifle site. Last year, the State of Colorado passed into law an act permitting the application of "environmental covenants," which essentially allow institutional controls to be applied to a piece of property indefinitely as long as it is protective of human health and the environment. DOE also installed treatment units on drinking water wells located hydraulically downgradient of the New Rifle site that belong to the few groundwater users and provided funding to extend a City of Rifle waterline to cover affected properties.

With the addition of these protective measures, DOE is proposing a compliance strategy of no remediation for vanadium in the alluvial aquifer, in conjunction with application of an alternate concentration limit for vanadium and establishment of institutional controls for the site. The natural flushing compliance strategy for other constituents remains the same. DOE–GJO is currently updating the Environmental Assessment document and the Groundwater Compliance Action Plan for the New Rifle site to include the new compliance strategy for vanadium. Once the revised Environmental Assessment has been issued for public review, DOE–GJO plans to conduct a public meeting to accept comments from the affected community.

For more information about the New Rifle UMTRA Ground Water Project site, contact Don Metzler, DOE–GJO Project Manager, at (970) 248–7612.❖

Team Project Focuses on Microbial Research

Microorganisms can alter the ability of groundwater to transport contaminants, but the microbial component of groundwater systems has typically received less attention than other aspects, such as hydraulics and inorganic geochemistry.

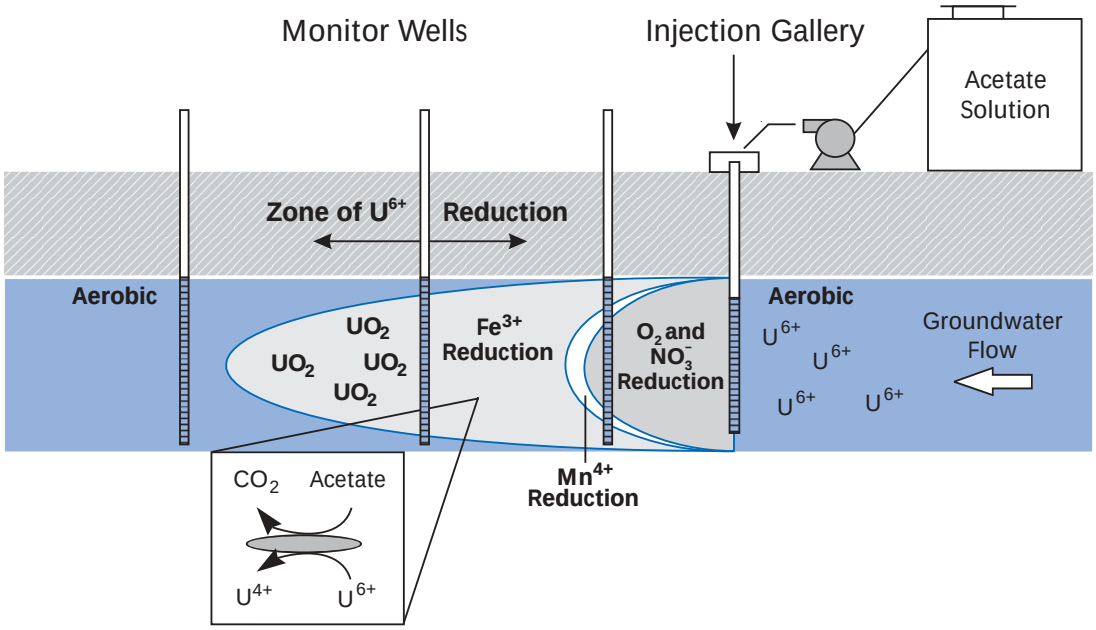
The Natural and Accelerated Bioremediation Research (NABIR) Program, directed under the U.S. Department of Energy (DOE) Office of Science, has teamed with the Uranium Mill Tailings Remedial Action (UMTRA) Ground Water Project at the DOE Grand Junction Office (GJO) to investigate the effects of subsurface microbial organisms. The mission of the NABIR Program is to provide the scientific understanding needed to use natural processes and to develop new methods to accelerate those processes for the bioremediation of contaminated soil sediments and groundwater at DOE facilities.

The teaming arrangement between NABIR and the UMTRA Ground Water Project came about during sidebar discussions of DOE–GJO personnel and NABIR Program scientists at several Office of Science gatherings between 1995 and 1997. During these discussions, it became apparent that groundwater aquifers at UMTRA Ground Water Project sites have characteristics that are more suitable than aquifers at many other DOE sites to test theories about microbial interactions. Compared to other DOE sites, UMTRA Project sites are more favorable because the groundwater aquifer systems have been well-characterized over many years, the groundwater systems are relatively small with simple hydrology and geochemistry, multiple sites allow a variety of systems for study, and site logistics allow rapid implementation.

Under the direction of Dr. Phil Long of Pacific Northwest National Laboratory, NABIR established a field research program at UMTRA Project sites in 1998. Working with Don Metzler, DOE–GJO UMTRA Ground Water Project Manager, the NABIR Program collected microbial data from three UMTRA Project sites: Shiprock, New Mexico; Gunnison, Colorado; and Rifle, Colorado. These sites were selected on the basis of ample uranium contamination in the shallow groundwater; the presence of potential nutrients, such as nitrates, in the groundwater; the selected groundwater compliance strategy for the site; and the status of cleanup activities at the site.

Technology Tested at Rifle, Colorado

Some microbes are particularly capable of removing uranium from groundwater. This year, an UMTRA Ground Water Project site at Rifle, Colorado (the Old Rifle site), was selected to test an in situ technology for remediating uranium contamination in groundwater. A former mill at this site processed uranium ore from 1958 to 1972, producing about 350,000 tons of tailings. The remediation technology consists of adding acetate to the aquifer to stimulate an indigenous population of uranium-reducing microbes, resulting in the removal of soluble uranium from groundwater. This process was previously shown to be effective in laboratory investigations.



Predicted distribution of biogeochemical processes that occur during acetate injection. The addition of acetate to the aquifer stimulates a native population of uranium-reducing microbes (figure provided by NABIR Program).

The demonstration facility at Rifle consists of 40 wells drilled to approximately 20 feet below ground surface. Acetate injections began in April 2002 and continued for 6 to 8 weeks. Analyses of sediment and groundwater samples collected before, during, and after acetate injection will provide data that will be evaluated to determine the potential of in situ biostimulation to immobilize uranium within the subsurface of uranium-contaminated aquifers.

“Understanding of the role of microbes in groundwater is important to evaluate passive remediation by natural flushing and to develop new active remediation technologies by intentionally manipulating subsurface microbial populations,” said Stan Morrison, who has had a long-time association with the NABIR Program and is a Principal Scientist for DOE–GJO contractor MACTEC Environmental Restoration Services (ERS).

Sam Marutzky is the MACTEC–ERS UMTRA Ground Water Project Lead and the lead for the NABIR work at GJO. Marutzky sees the NABIR involvement as beneficial to the UMTRA Ground Water Project because it “plugs us in to a larger community and offers an opportunity to share ideas with many researchers across the DOE complex.”

For more information about the NABIR Program, contact Don Metzler, DOE–GJO Project Manager, at (970) 248–7612.❖

Water Recycling Study Supports Southwest Border Initiative

The U.S. Department of Energy Grand Junction Office (DOE–GJO) is using its extensive track record for solving contaminated groundwater problems to assist the DOE National Border Technology Partnership Program, a multi-agency initiative to alleviate environmental problems along the United States–Mexico border.

Many environmental conditions, caused in part by rapid economic development, are contributing to the growing health issues in the border communities. Efforts have focused on application of innovative technologies to solve hazardous waste management concerns that threaten public health and environmental security and to help improve socioeconomic conditions along the border.

Paul Ganster (left), Director of the Institute for Regional Studies of the Californias, and Don Metzler, DOE–GJO Project Manager, tour the analytical laboratory at the South Bay Water Reclamation Plant near San Diego, California.

New Plant To Treat Wastewater

One such concern is along the border between San Diego, California, and Tijuana, Mexico. Untreated sewage, flowing from Tijuana in the Tijuana River to the Pacific Ocean, was adversely affecting the South Bay communities of San Diego, the Tijuana River valley and estuary, and coastal waters of the United States. To solve this problem, the U.S. and Mexican Governments agreed to construct the South Bay International Wastewater Treatment Plant to treat and dispose of the Tijuana sewage.

The U.S Environmental Protection Agency and the International Boundary Water Commission own the treatment plant. Presently, an average of 25 million gallons per day of wastewater is treated and discharged into the Pacific Ocean through a wastewater pipeline.

The City of San Diego also recently built its own South Bay Water Reclamation Plant (adjacent to the international plant) to treat sewage generated in the San Diego area. However, with unprecedented population growth on both sides of the border, water is quickly becoming a scarce and precious resource. Tijuana has an immediate need for more water because demand already exceeds its available drinking water source.

Transborder Water Recycling Study

One of the potential water-use alternatives for both sides of the border is to treat the sewage to meet California reclamation water quality standards, reinject it into the underlying aquifer, and use the treated effluent as potable water in the future. The

DOE Carlsbad Field Office, which is heading up the DOE Headquarters' Southwest Border Initiative, has funded DOE–GJO to conduct a Transborder Water Recycling Study. This feasibility study would evaluate the potential to use water from the water reclamation facility in San Diego to recharge the Tijuana aquifer in Mexico and in California along the border.

South Bay Water Reclamation Plant near San Diego, California.

"If the characteristics of this unstudied aquifer are amenable for reinjection of treated water, then the use of treated effluent as a water resource could build a bridge between the governments of Mexico and the United States, minimizing the inefficient practice of wasting millions of gallons of water per day," said Don Metzler, DOE–GJO Project Manager. The project is being conducted in cooperation with the City of San Diego, the State of California, the California Environmental Protection Agency, and the Government of Mexico. The State of California is cost sharing the study with DOE.

Results of the DOE–GJO study will be included as an appendix to the master plan being developed by the City of Tijuana for the delivery of recycled water from the South Bay Water Reclamation Plant to points of beneficial use on both sides of the border. The calibrated groundwater flow model being developed by DOE–GJO is critical in evaluating the feasibility of using reclaimed water to help solve severe water shortages south of San Diego.

"This study is an important piece of the puzzle in determining the water needs for San Diego, Tijuana, and the entire region because it will provide valuable information that neither city currently has," said Elsa Saxod, Binational Coordinator for the City of San Diego. The reinjected water would improve both the quantity and quality of water in the affected areas. The projected use of the reclaimed water would provide drinking water to more than 1 million people. In addition, it would likely reduce the amount of saltwater intrusion that is currently occurring in aquifers in Southern California and Mexico.

The next step in the project is to characterize the aquifer in Tijuana. "I'm excited about this project because it involves using water resources and water technologies in new ways," said Metzler. The study is scheduled to be completed by December 2002.

For more information about the Southwest Border Initiative or the Transborder Water Recycling Study, contact Don Metzler, DOE–GJO Project Manager, at (970) 248–7612.❖

Uranium ore was mined at the Königstein mine (headframe shown above) in Germany from the 1950s until 1991. The map shows the locations of the Königstein mine and other uranium mines that are being remediated by WISMUT, a German government-owned environmental remediation firm.

DOE–GJO Continues Tradition of International Technical Exchanges

The U.S. Department of Energy Grand Junction Office (DOE–GJO) has a history of technical exchanges with other countries that have similar environmental problems to solve. Two of these countries are Germany and Australia.

Following the end of World War II, Eastern Germany was in a race with the West to explore, mine, and process uranium ore as part of the Cold War defense programs buildup. The former Union of Soviet Socialist Republics started exploration and mining of uranium in the historic provinces in the Ore Mountains.

WISMUT Activities

Subsequently, WISMUT, a German government-owned environmental remediation firm, developed the third largest uranium-mining province in the world (after the United States and Canada) in the southern part of the then-German Democratic Republic. Information on this vast operation was not publicly accessible until the late 1980s.

WISMUT conducted extensive uranium mining and milling operations from the 1950s until reunification of the German states in 1991. Following reunification, all uranium-mining operations were terminated. It has been said that "Wismut," which is the German word for the element bismuth, was a code name for the company and was used to conceal the true purpose of the enterprise. More than 400,000 people worked with the WISMUT enterprise during the Cold War years.

Since 1991, WISMUT has conducted the work necessary for shutdown and reclamation of uranium mines. Because the former mill operators reserved no funds for remediation, the cleanup is funded by the federal budget. The German government estimates the cleanup period at 10 to 15 years, at a cost of $9.5 billion. WISMUT is managing the largest and most successful environmental restoration project in Europe. The program is more than 75-percent complete and the most difficult challenge, the in situ leach mine at Königstein, Saxony, has a regulatorily accepted rehabilitation plan.

The Königstein uranium deposit was mined conventionally in the 1970s. Since 1981, it was mined by in situ leaching that involved injection of dilute sulphuric acid into the orebody, which in some cases required blasting to make the sandstone host rock sufficiently permeable. The solution containing uranium that was leached from the ore was pumped to a plant at the surface, where the uranium was recovered by ion exchange. Process water generated during the recovery was then re-acidified and pumped back underground. The plant also produced dilute waste slurry that was discharged into settling ponds. Wastewater from the plant was discharged into the

nearby Elbe River. Although each leached area was allowed to drain on cessation of leaching, a residue of acid remained entrained in the sandstone.

Recently, WISMUT completed two large-scale flooding experiments that lasted several years. Pilot tests are being used to calibrate WISMUT's flooding computer models and the predictions will be used to assess long-term effects on the environment.

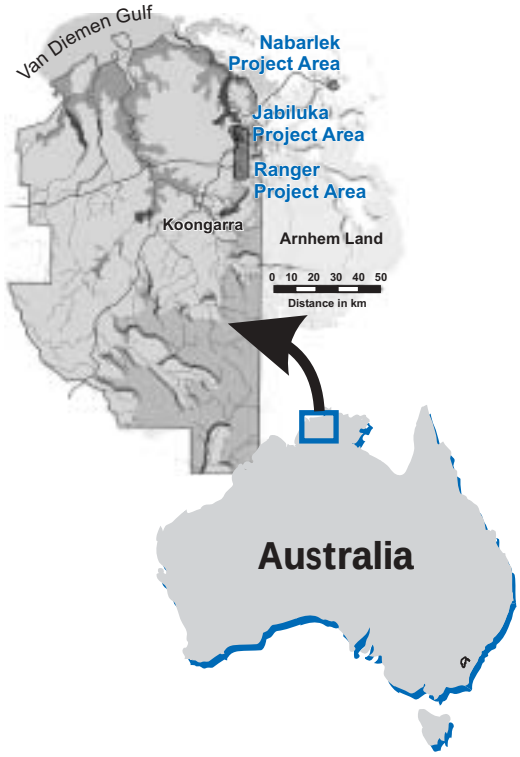
In February 2002, two WISMUT management team members, Dr. Manfred Hagen and Dr. Alex Jakubick, visited GJO. This technical exchange gave many of the scientists and engineers in the UMTRA Ground Water Project and Long-Term Surveillance and Maintenance Program at DOE–GJO the opportunity to present their work and discuss their findings. Presentations were given on disposal cell designs and long-term maintenance issues, as well as various groundwater remedial action alternatives, such as pump-and-treat methods, pilot tests using innovative treatment technologies for removal of vanadium and selenium, and permeable reactive barriers.

Australian Operations

The other apex to this most recent technical exchange triangle involves Australia. Earlier this year, Peter Waggitt, Office of the Supervising Scientist, Environment Australia, was in Fort Collins, Colorado, for the annual Mines and Tailings Conference that is organized by the Engineering Department at Colorado State University. The conference served as a forum for representatives from other countries that are cleaning up mill tailings piles. Waggitt arranged to visit DOE–GJO following the conference.

As part of his visit, Waggitt gave a brown-bag presentation on uranium mining in Australia. He is responsible for government oversight of uranium mining in Australia's Northern Territory. This area includes the mines and mills at Jabiluka, Ranger, and Koongarra (see map at right).

One of the most interesting aspects about the Australian mining operations is that the Australian Commonwealth requires all uranium mill tailings disposals to be below grade. One obvious benefit of below-grade disposal is the minimal amount of active long-term care that will be required to maintain the disposal cell. The only Uranium Mill Tailings Radiation Control Act Title I site where the tailings were disposed of below grade is at Spook, Wyoming. The other 18 disposal cells are above grade or a combination of partial below grade and above grade (e.g., Green River, Utah).



This map shows the loaction of uranium mines in the Northern Territory of Australia.

"When different countries with similar problems can sit down, roll up their shirt shelves, and discuss in detail how they are solving the problem—this is when these technical exchanges pay dividends," says Don Metzler, DOE–GJO Project Manager. "The 'across-the-table' dialogue produces an excellent hybridization of ways to solve similar problems."

The next technical exchange is planned to coincide with the Uranium Mining and Hydrogeology UMH III conference in Freiberg, Germany, in September 2002.❖

Mother Nature: A Groundwater Solution (continued from page 5)

does not qualify for supplemental standards or alternate concentration limits. Using an active remediation strategy, such as the pump-and-treat method, has not proven to be an effective strategy nor an economical one because of the high cost associated with the operation and maintenance of a pump-and-treat system and a less expensive, effective solution is available. Metzler feels strongly that the most appropriate option for the Gunnison site is natural flushing with institutional controls and continued monitoring.

Natural Flushing Strategy

The natural flushing strategy allows natural groundwater movement and geochemical processes to decrease contaminant concentrations below regulatory limits within a period of 100 years. Results of groundwater modeling (i.e., computer simulations) for the Gunnison site predict the uranium contamination will naturally disperse through the alluvial (sands and gravel) system to be below the maximum concentration limit within 100 years.

When asked the difference between "do nothing" and natural flushing, Metzler responded, " 'Do nothing' is DOE walks away, we leave town. Natural flushing is where we study it intensely, we monitor it, we have institutional controls, and we help fund the expansion of the alternate water supply system. And if natural flushing, for some unforeseen reason, is not effective in meeting cleanup objectives within a timely manner, contingency remedies will be implemented."

In 1994, a permanent alternate water supply system, funded by DOE and the State of Colorado, was constructed for the residents who have wells in and adjacent to the contaminant plume. The expansion of this water supply is being discussed. The municipal water supply for the City of Gunnison is unaffected by the contamination because it comes from wells in the alluvial aquifer upgradient of the former processing site.

Much of the discussion stemmed from concern by residents about placing institutional controls on an area in which the county has encouraged development. Institutional controls are restrictions that effectively protect public health and the environment by limiting access to the contaminated groundwater. The ideal institutional control for the Gunnison site would allow all landowners to have access to the groundwater for irrigation uses but would prohibit using untreated groundwater for drinking water purposes. Landowner access to drinking water via an alternate water supply in the affected area would be a component of the institutional control.

Environmental Assessment

Metzler responded to written comments and questions from meeting attendees via personal letters. Further information on the proposed compliance strategy of natural flushing will be available in an updated Environmental Assessment report being prepared for the Gunnison site. An Environmental Assessment is a document required by the National Environmental Policy Act that provides information on how a proposed remediation strategy will affect the environment. DOE anticipates the revised Environmental Assessment will be completed by mid-summer 2002.

For more information about the Gunnison UMTRA Ground Water Project site, contact Don Metzler, DOE–GJO Project Manager, at (970) 248–7612.❖

GJO Prepares for Busy Summer (continued from page 2)

of the paper, including originality, accuracy of content, justifiable conclusions, and quality of the presentation, including logical organization, use and value of visual aids, and presenter delivery.

Pinellas Project

After a lengthy search and selection process for remediation technologies, DOE has begun preparations for the remediation of non-aqueous phase liquids at the Pinellas Project Northeast Site in Largo, Florida. This project has a rigorous schedule to meet. Construction of the in situ remediation system began in late May and drilling and well installation are in progress. The operation phase will last for 90 days and will be followed by performance monitoring (groundwater and soil sampling) to evaluate the success of the technology. In an effort to keep our affected communities informed about our projects, DOE met with various groups of stakeholders for the Pinellas Project. These stakeholders were very receptive to our upcoming remediation activities. For more about this interesting cleanup project, see page 20.

Moab Project

Last October, DOE–GJO submitted a draft *Preliminary Plan for Remediation*, which evaluates remedy alternatives for the Moab (Utah) Project Site, to the National Academy of Sciences for review. DOE received comments on the plan in June. As a result of the Academy's comments, DOE must further study the options of relocating the uranium mill tailings pile or capping it in place. DOE plans to host a public meeting later this summer to get public input on possible remediation plans. The article on page 16 provides a status of current activities for the Moab Project.

Long-Term Surveillance and Maintenance Program

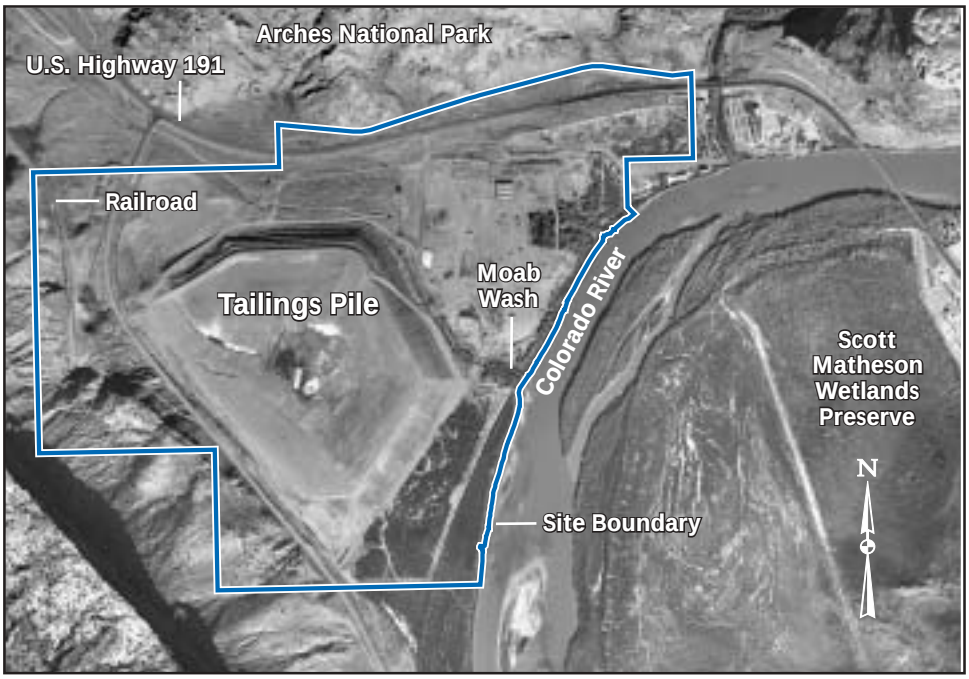
Cleanup activities at the DOE Weldon Spring Site near St. Louis, Missouri, are being conducted under the Weldon Spring Site Remedial Action Project, which is administered by the DOE Oak Ridge Operations Office. The DOE–GJO Long-Term Surveillance and Maintenance (LTSM) Program will assume responsibility for the management of the Weldon Spring Site when it transfers to long-term stewardship on October 1, 2002. GJO has taken immediate responsibility for completing the long-term stewardship plan for the site. I am confident that we can continue the success that has been achieved at Weldon Spring as we strive to manage this transition in an efficient and effective manner. We will keep you updated on the transition of this newest site in the LTSM Program.

Monticello Project

The Monticello (Utah) Project, with the exception of the surface water and the groundwater, was transferred to the LTSM Program last October (see related article on page 18). Changing conditions in the contaminated surface water and groundwater, which resulted from the Monticello millsite remediation and site restoration, made it impractical to proceed with selection of a final cleanup remedy for this portion of the project. After implementing an interim remedial action, DOE, along with the U.S. Environmental Protection Agency and the Utah Department of Environmental Quality, believes that conditions have stabilized in the surface water and groundwater and post-remediation conditions at the Monticello millsite have been sufficiently characterized.

Continued on page 31

Moab Project Assigned



Activities at the Moab, Utah, Project Site include collecting air, soil, and groundwater samples; dewatering the 130-acre tailings pile; and adding signage around the property boundary.

Since assuming responsibility for the Moab (Utah) Project Site in October 2001, the U.S. Department of Energy Grand Junction Office (DOE–GJO) has been busy becoming familiar with the history of the site and current conditions.

Current Activities

Activities at the site include maintaining the site, implementing radiation control procedures, managing blowing dust, installing air monitoring stations, dewatering the massive 130-acre uranium mill tailings pile, and characterizing soils and groundwater. The most visible changes to the site include placement of signage around the property boundary alerting the public to the radiological component of the site and the addition of trailers to provide office space for site personnel. The warehouse facility that previously served as the original site office has been abandoned and excess laboratory chemicals that were stored in the warehouse are being managed for proper disposal.

Dust blowing from the tailings pile to the nearby city of Moab has been a public health concern. DOE is attempting to effect a no-dust policy at the site perimeter and has been applying a surfactant to the tailings pile to stabilize the pile and help eliminate dust. The DOE Fugitive Dust Control Plan was submitted to the State of Utah Division of Air Quality. To further reduce dust, a water truck has been available 7 days a week to spray the pile during spring dust storms. DOE continues to study and consider better methods that would limit blowing dust for longer periods of time.

New air monitoring stations both on and off the site have been installed. These stations monitor radon, gamma, and air particulates. Monitoring results will be compiled quarterly and placed on the DOE–GJO Internet website at **www.gjo.doe.gov/moab/moab.html**.

To dewater the tailings pile, the former site trustee installed a system of 17,000 “wicks” (vertical band drains) in the pile prior to DOE site ownership. The wicks operate via two mechanisms: capillary action and pressure applied from the weight of the tailings. Overburden material was added to the pile to provide supplementary weighting. A lined evaporation pond has been constructed in the center portion on the top slope of the tailings pile to collect the water being pumped from the pile through the wicking system.

to Grand Junction Office

A major effort to update and substantiate previously collected groundwater data is also under way. Piezometers, well-like devices used to measure water levels, are being installed in the pile and around the site. Characterization data gathered from these piezometers will be used to better understand the site conceptual groundwater model, which will help predict the success of potential compliance strategies.

Planned Activities

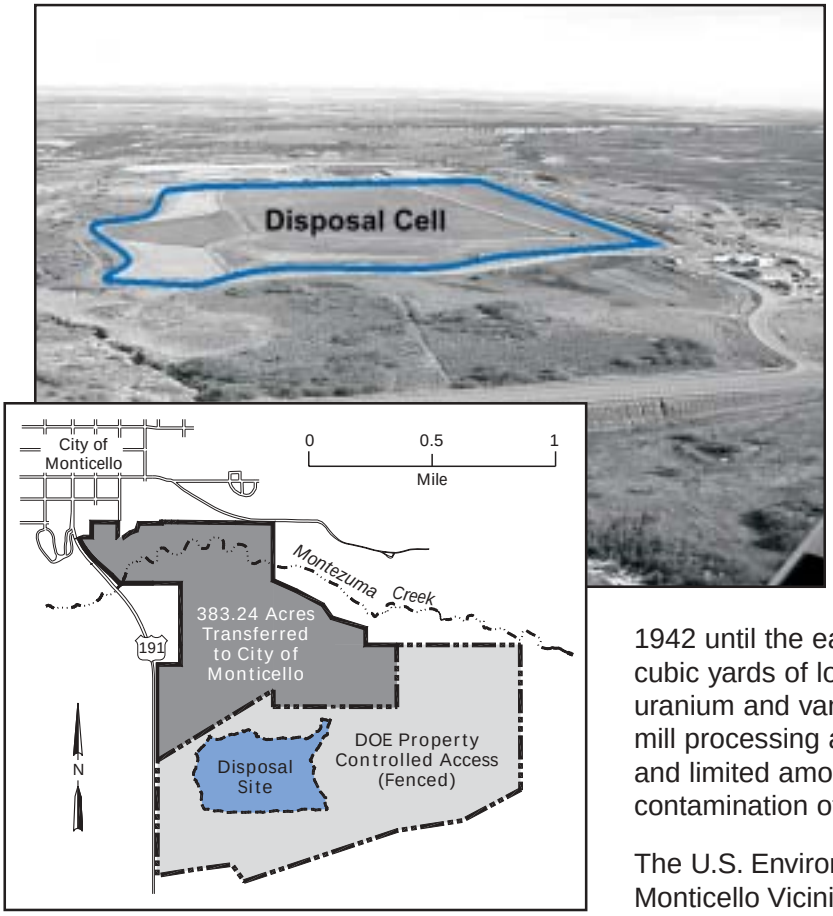
Additional planned site activities for the summer months include implementing storm water pollution prevention controls to prevent runoff from the tailings pile into Moab Wash or the Colorado River. The tailings pile and areas around Moab Wash, which is located along the east side of the pile, will be regraded so that runoff does not enter the wash. A mesh fence will also be installed along Moab Wash in some areas to keep silt from entering the wash. The containment berm between the pile and the river will be maintained.

The unusually low water level of the Colorado River has caused DOE to postpone implementing an action designed to dilute ammonia concentrations in the river. Ammonia concentrations have been measured at levels harmful to endangered fish species. An original concern was the concentration of ammonia in the back-water pools that serve as fish habitat; these pools form as the river rises during normal runoff years. However, the river is presently flowing at less than 5,000 cubic feet per second when the average during spring runoff is 18,000 cubic feet per second.

MACTEC Environmental Restoration Services employees inspect the bank of the Colorado River (top) that is located east of the Moab tailings pile (bottom).

To keep Moab residents up to date on current activities, DOE established a public reading room that contains project-specific documents at the local library. DOE personnel are available to the public, as needed, to provide information on site activities. For more information about the Moab Project, contact Joel Berwick, DOE–GJO Project Manager, at (970) 248-6020 or visit the Internet website for the project at **www.gjo.doe.gov/moab/moab.html**.❖

Monticello, Utah, Project Transfers to LTSM Program



Seeding of the cover in 2000 signified completion of the Monticello, Utah, Disposal Cell. The cell contains tailings and tailings-contaminated material from vicinity properties, peripheral properties, and the former millsite.

With completion of surface remediation and closure of the Monticello, Utah, Disposal Cell, the Monticello Project was transferred to the U.S. Department of Energy Grand Junction Office (DOE–GJO) Long-Term Surveillance and Maintenance (LTSM) Program for maintenance of the final remedies on October 1, 2001. LTSM Program activities for the Monticello Surface Water and Ground Water Project will be identified after a final remedy has been selected.

The DOE–GJO LTSM Program conducts monitoring activities related to the on-site disposal cell and to supplemental standards properties where contamination was left in place.

Operation of the mill at Monticello from 1942 until the early 1960s generated approximately 2.5 million cubic yards of low-level radioactive waste from processing uranium and vanadium ores. Contaminated materials from mill processing activities were distributed by wind and water and limited amounts were used for construction, resulting in contamination of more than 400 vicinity properties.

The U.S. Environmental Protection Agency (EPA) placed the Monticello Vicinity Properties Site on the National Priorities List in 1986 as the Monticello Radioactive Contaminated Properties. The Monticello Mill Tailings Site was added in 1989. DOE entered into an agreement with EPA and the State of Utah to clean up the tailings and tailings-contaminated material under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Cleanup of the tailings minimizes risks to the public and the environment from exposure to these mill tailings and the radon gas they produce.

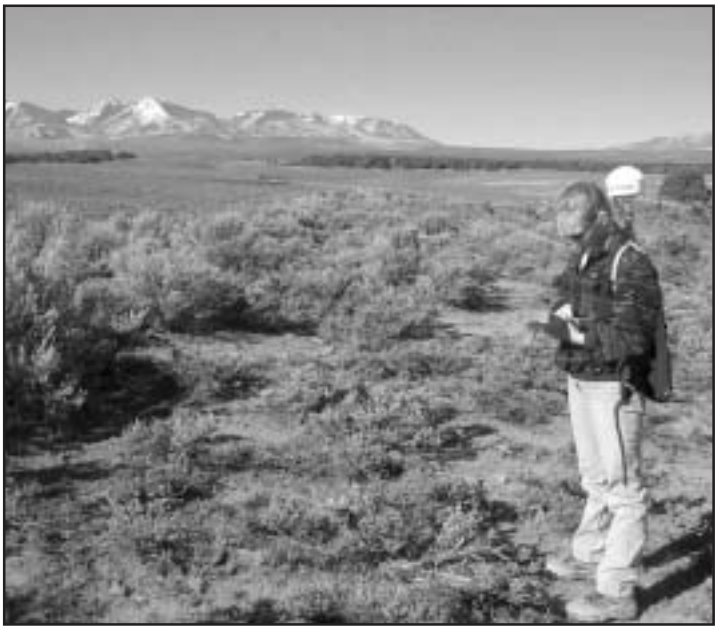
EPA deleted the Monticello Vicinity Properties Site from the National Priorities List on February 28, 2000, following verification of the remediation. Contaminated materials from the vicinity properties, peripheral properties, and the former millsite were deposited in a disposal cell south of the former millsite. Disposal cell cover materials were emplaced in 1999, and the cover was seeded in 2000.

Surveillance and Maintenance Activities

As part of the CERCLA process, DOE chose a remedy that includes monitoring the sites, with oversight provided by EPA and the Utah Department of Environmental Quality, to ensure compliance with applicable or relevant and appropriate regulations

and to ensure that completed remedial actions maintain protection of human health and the environment. DOE contractors perform many of the necessary long-term surveillance and maintenance activities specific to Monticello, which include

- Monitoring the leachate collection system of the disposal cell to ensure the integrity of the liner.
- Monitoring the vegetative cover of the disposal cell for erosion and settlement and evaluating the success of the vegetation.
- Maintaining pumps and other mechanical systems, telemetry, fences, and storm water controls.
- Receiving and responding to public inquiries.
- Providing support for any work pertaining to city streets and utilities, such as surveying excavation spoils for contaminated soils, isolating the contaminated material, and furnishing a temporary storage facility for contaminated material until it can be transported to the Grand Junction, Colorado, (Cheney) Disposal Cell.



Shawna Vance, a MACTEC Environmental Restoration Services employee, uses a global positioning system to determine specific locations on the disposal cell top slope as part of the CERCLA 5-year review inspection of the Monticello site.

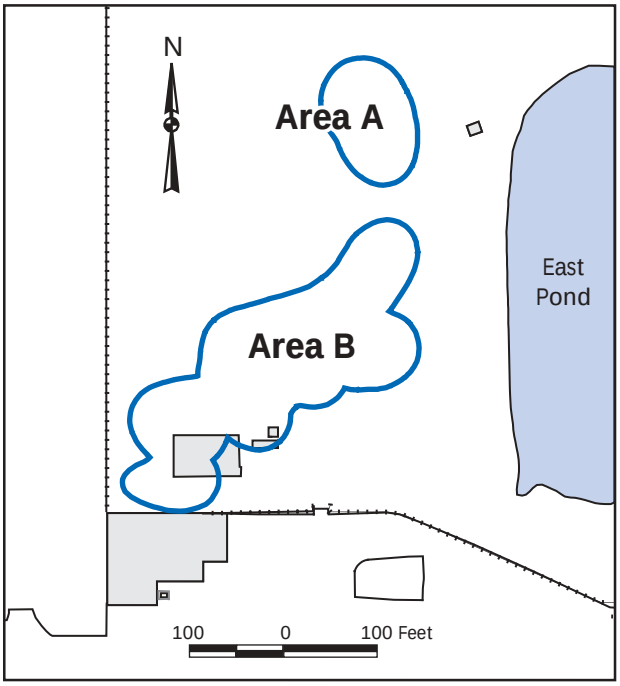
- Providing oversight to supplemental standards properties that includes surveillance for erosion or disturbance of soils and checking for unauthorized construction.
- Providing oversight of any construction work performed by the Utah Department of Transportation on certain portions of Highway 191 because of the supplemental standards applied to steep embankments, surveying spoils for contamination, and furnishing temporary storage for contaminated material until it can be transported to the Grand Junction Disposal Cell.
- Conducting radiological surveys to support construction of habitable structures on private supplemental standards properties.

The LTSM Program is responsible for conducting a review of the Monticello site every 5 years to ensure that the completed remedy remains protective of human health and the environment. These 5-year reviews, which are required by CERCLA Section 120 (c), include input from the community. The CERCLA 5-year review consists of public notification that the review is being conducted, a physical inspection of the site, reviews of data, interviews with local government officials and citizens, and preparation of a report that presents summaries of findings and recommendations. The most recent 5-year review report was completed in June 2002.

For more information about the Monticello LTSM Program site, contact Art Kleinrath, DOE–GJO Program Manager, at (970) 248–6037.❖

NAPL Remediation Merits Innovative Technologies

The U.S. Department of Energy (DOE) plans to implement two aggressive innovative technologies this summer to address a 1-acre area contaminated with non-aqueous phase liquids (NAPLs) at the northeast corner of the Young-Rainey Science, Technology, and Research (STAR) Center in Largo, Florida, formerly known as the Pinellas STAR Center and the Pinellas Plant. This cleanup is being conducted as part of the Pinellas Environmental Restoration Project that is managed by the DOE Grand Junction Office.



Groundwater remediation with steam injection and the Electro Thermo Dynamic Stripping Process at Area A of the Northeast Site at the Young-Rainey STAR Center is scheduled to begin in September.

Former DOE Facility

DOE owned and operated the Pinellas Plant before 1995. The facility was contaminated with organic solvents and metals that were used to manufacture neutron generators and other devices. As a result of historic waste disposal practices, NAPL contamination exists in the subsurface. NAPLs, particularly organic solvents such as trichloroethene (TCE) and dichloroethene (DCE), are among the most common of environmental contamination problems in the United States and for most industrialized countries. These solvents were used in previous DOE Pinellas Plant activities. NAPLs pose long-term groundwater contamination problems because of their limited solubility in groundwater and significant potential for migration.

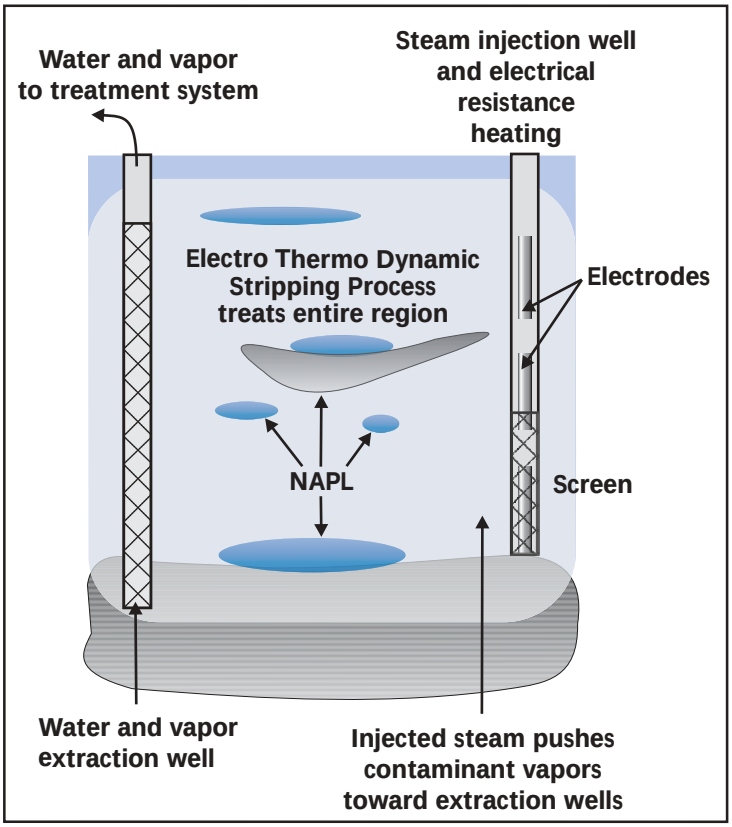
If not remediated, NAPLs will continue to slowly dissolve into the groundwater over a period of years, prolonging groundwater cleanup efforts. In addition to directly contaminating the groundwater, NAPLs may break down and form other hazardous substances, such as vinyl chloride, that can threaten human health, dramatically increase cleanup costs, and inhibit land reutilization.

When NAPLs were discovered at the Northeast Site (see figure at left) where groundwater remediation efforts were already under way, DOE immediately initiated an extensive characterization effort. The resulting studies have defined both the types of NAPL contaminants present and the extent of the contaminant area, called the plume. DOE awarded a contract to SteamTech Environmental Services of Bakersfield, California, to perform NAPL remediation activities at the site.

“Implementation of this cleanup project follows nearly 2 years of extensive review of potential treatment technologies by DOE, its contractor, various regulatory agencies, and private industry,” said David Ingle, DOE–GJO Environmental Specialist. SteamTech will utilize two innovative technologies to clean up the contamination: in situ thermal remediation (steam injection) and an electrical resistive heating process known as the Electro Thermo Dynamic Stripping Process.

Cleanup Technologies

In situ thermal remediation by steam injection uses boilers to generate steam, which is then pumped into injection wells that have been placed in the ground surrounding the contaminants (see figure at right). Used in conjunction with the Electro Thermo Dynamic Stripping Process, the steam front converts the contaminants to a vapor that allows them to move more readily through the soil. The steam front continues to push the contaminants toward a central network of extraction wells for removal and prevents movement of the contaminants outside the treatment zone.



This schematic shows the remediation technologies that will be used to clean up non-aqueous phase liquids in the groundwater at the Northeast Site at the Young-Rainey STAR Center.

The Electro Thermo Dynamic Stripping Process technology removes contaminants from soil and groundwater by passing an electrical current through the soil. The passage of current generates heat because of electrical resistance within the soil. This is the same process used in any electrically heated device (e.g., clothes iron, heater, stove). Generation of heat throughout the soil in the remediation area increases the temperature of the soil to the boiling point of water. Moisture in the soil is transformed into steam that is captured by recovery wells for removal.

Field construction of the treatment system began in May 2002, and remedial activities are expected to begin in September. In preparation for cleanup, DOE will conduct several public involvement activities during the summer, including visits with adjacent business owners, a briefing to county officials, a public availability session, and a public meeting, to discuss the upcoming remediation with affected community members.

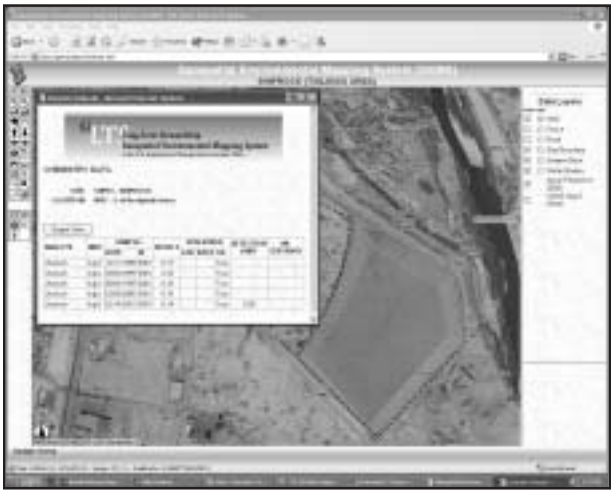
To ensure that the selected technologies are successful, initial efforts, expected to take approximately 8 months, will focus on Area A, the smaller area of contamination at the northern edge of the plume (see figure at left). If successful, the use of the selected technologies will be extended to the remainder of the plume in Area B. The entire NAPL remediation effort is expected to take 3 to 4 years.

For more information about the DOE Pinellas Project or NAPL remediation at the Northeast Site, contact David Ingle, DOE–GJO Environmental Specialist, at (727) 541–8943.❖

Long-Term Stewardship Pilot Projects Being Implemented

Interest in historic and current environmental monitoring information for sites in the U.S. Department of Energy (DOE) complex continues even as sites are transferred to the Long-Term Surveillance and Maintenance (LTSM) Program managed by the DOE Grand Junction Office (GJO).

Last summer, the DOE Office of Long-Term Stewardship awarded funding to DOE–GJO through its pilot project initiative for two projects that focus on geographic information systems and data management. Both projects are under way.



An example of the data that will be available to stakeholders when the project is completed.

Geographic Information System Pilot Project

The objective of the Geographic Information System Pilot Project is to develop an Internet-based Geographic Information System (GIS) that will allow display of environmental monitoring data on maps on a site-specific basis for sites currently in the LTSM Program.

Task I of the GIS pilot project was to complete a needs assessment. To ensure that the system being designed would meet the needs of the users, an eight-page questionnaire was prepared and sent to DOE personnel and its contractors, regulators, lawmakers, and other LTSM Program stakeholders. Results of the questionnaire were compiled in the *Information Needs Assessment and Web Application Specification*s report that is available on the DOE–GJO Internet website at **http://gems.gjo.doe.gov** (click on the LTS GIS Needs Assessment Report button). General conclusions identified in this report include

- Significant interest exists to make information pertaining to compliance and monitoring activities at the LTSM Program sites available on an Internet-based GIS website.
- Timely availability of dynamic (current) spatial data associated with a site is of particular interest.
- Special information requirements resulting from unique site monitoring or maintenance activities exist.
- User information needs and the customized web-browser user interface requirements may vary because of stakeholder diversity and unique site conditions.
- The long-term viability of an Internet-based GIS will hinge on the cost effectiveness and timeliness of new data being made available.

The features and information determined to be of greatest interest include site and institutional control boundaries, monitoring locations (monitor wells, boreholes, surface sample/air monitoring locations), contaminant plume boundaries or concentrations, current and historic photographs, and groundwater-level information.

Significant progress has also been made on Task II, prototype development. This task consists of developing the prototype web-based application for one of the sites currently in the LTSM Program. Four special tools are being developed to display data collected at specific sample locations:

- Basic information such as type of sample location (e.g., monitor well, surface location); coordinates; and monitor well attributes (e.g., date drilled, zone of completion, and depth), if applicable.
- Analytical results for a user-specified analyte and date range.
- Analytical results of all analytes from the last sampling event.
- Water-level information over time.

Two other tools being developed will allow the user to view photographs taken at certain locations and to access well completion logs. A demonstration of the prototype for one site is planned for this summer. The project will be completed by September 30, 2002, with the inclusion of all sites that are currently in the LTSM Program.

Data/Records Access for Stakeholders Pilot Project

The purpose of this pilot project is to provide all external stakeholders with efficient storage, retrieval, and dissemination of information regarding long-term stewardship (LTS) sites. Access to the information and search capabilities needed to be developed to satisfy the information needs of the stakeholders. The first phase of this project, which was to create a new master LTS website that accesses select portions of the DOE–GJO Records Log System, is complete.

DOE–GJO created an LTS records website that was activated in April 2002. The website address is **http://lts1.gjo.doe.gov**; the website is also accessible from the opening page of the LTSM Program website (**http://www.gjo.doe.gov/programs/ltsm/**) by clicking on the LTS Records button. In addition to an LTS records search engine that has search capabilities for a wide range of site-specific records, the website allows the user direct viewing of key LTS documents. Documents that are available on the LTSM Program website are also easily accessed from a Stewardship Sites page on the LTS records website that links to each of the 29 existing sites in the LTSM Program.

The second phase of the pilot project was to identify hardcopy records and documents that required scanning and formatting as Adobe Acrobat files in .pdf format for placement on this new LTS records website. A total of 225 records and documents, consisting of more than 57,000 pages, can now be viewed on the website. Also as part of the second phase, a cost and benefit analysis was performed to determine whether to enhance the current GJO Records Log System or procure a new records management application. The result of the analysis was a recommendation to enhance the current GJO Records Log.

Work has begun on the third and final phase, which is to implement an Enterprise Information Portal for LTS documents across the DOE complex that will provide a common, customizable user interface and search capability.

For more information about the GJO LTS pilot projects, contact John Gilmore, DOE–GJO Project Manager, at (970) 248–6027.❖

Hanford Tank Farms Baseline Characterization Completed

In late fiscal year 2000, the U.S. Department of Energy Grand Junction Office (DOE–GJO) completed an extensive baseline characterization project for the DOE Richland Operations Office (DOE–RL).

The project began in 1994, when DOE–RL requested DOE–GJO to characterize the subsurface radioactive contamination in the vadose (unsaturated) zone sediments in the vicinity of the single-shell tank farms at the Hanford Site near Richland, Washington. This work utilized GJO expertise that is based on years of subsurface geophysics experience gained from the National Uranium Resource Evaluation (NURE) program.

Single-Shell Tanks

Liquid high-level nuclear waste resulting from previous plutonium production and processing at the Hanford Site was stored in large, buried tanks. There are 149 reinforced concrete tanks with containment vessels consisting of a single layer of steel. These single-shell tanks are located in 12 groups, called "tank farms," and range in capacity from 208,000 to 3,800,000 liters (55,000 to 1 million gallons) each. Sixty-nine single-shell tanks have been designated as "leakers," or "assumed leakers," and an estimated 1 million gallons of high-level mixed waste has been released into the vadose zone surrounding the tanks. Additional subsurface contamination has resulted from surface spills and pipeline leaks.

A spectral gamma-ray logging system was used to log boreholes in the single-shell Tank Farms at the Hanford Site near Richland, Washington.

Two borehole logging trucks with high-resolution, passive, spectral gamma-ray logging systems were specially fabricated for the baseline logging project. These systems are able to detect gamma-ray emissions from radionuclides like cesium-137; radionuclide concentrations from background levels to several thousand picocuries per gram can be quantified by analyzing recorded spectral data.

To determine the nature and extent of the subsurface contamination, DOE–GJO logged approximately 800 existing boreholes surrounding the 133 single-shell tanks with capacities of 2 million liters (528,000 gallons) or greater (100-series tanks). Detailed borehole log plots showing the distributions of natural and man-made radionuclides in relation to depth were prepared for each borehole. Antimony-125, cesium-137, cobalt-60, europium-152, europium-154, tin-126, uranium-235, and uranium-238 were the primary contaminants that were detected and assessed. These log data will serve as a baseline against which future measurements can be compared to identify changes and track ongoing contaminant movement in the vadose zone.

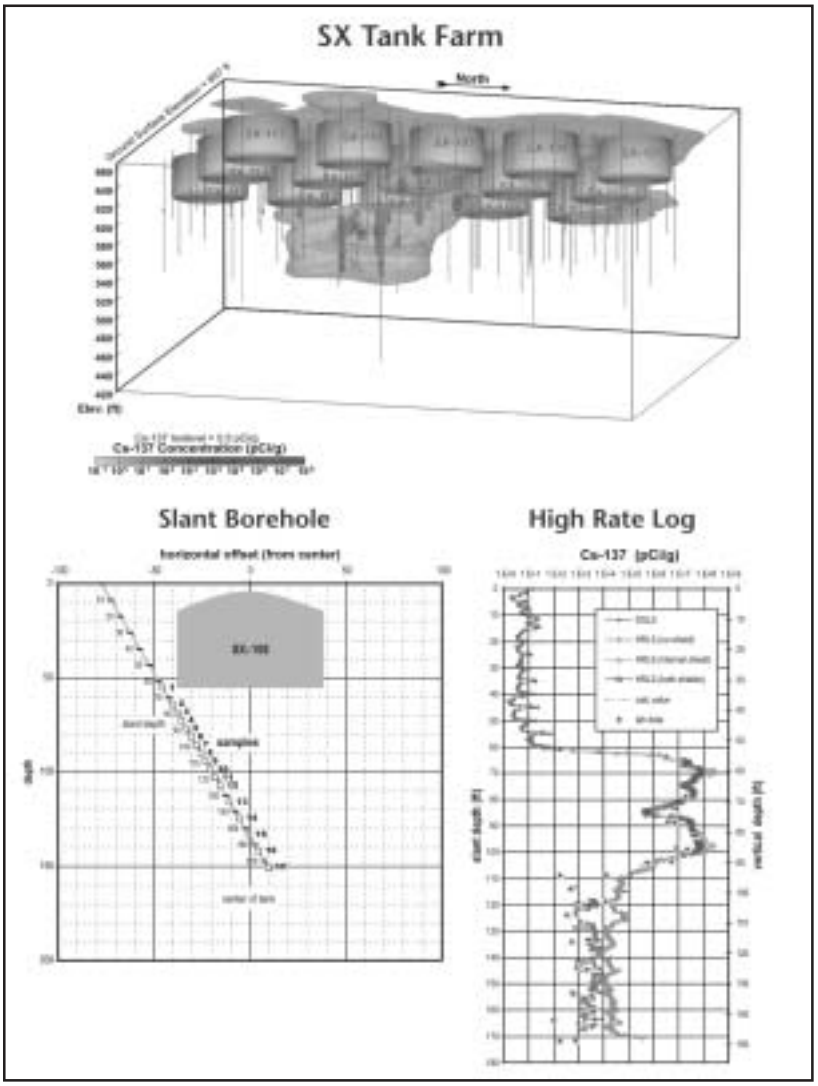
Spectrum Shape Factor Analysis

Conventional data analysis is conducted under the assumption that the contaminants are uniformly distributed in the medium surrounding the borehole. Because other distributions are possible, a specialized analytical method was developed to assist

in recognition of unusual contaminant distributions. The method, called spectrum shape factor analysis, uses counts in several energy windows in the part of a spectrum, called the Compton continuum, that is affected by source distribution. The method allows a data analyst to differentiate between contamination on the inside of the borehole casing, on the outside of the casing, or remote from the casing. Application of this method uncovered instances where detected contamination adhered to the casing, or was "dragged down" during the drilling process, and was not distributed in the sediments.

High-Rate Logging System

Some zones of such intense radiation were encountered that the original spectral gamma logging system was unable to record data. To log these zones, a system called the high-rate logging system was designed and deployed in 1999. The system has a detector with high resolution but low efficiency. High-rate logging was performed in 51 boreholes. Contaminant levels as high as 1 x 10^9 picocuries per gram of cesium-137 were observed. These data provided an improved basis to estimate the volume of contaminated soil and contaminant inventory in the vadose zone.



This three-dimensional visualization presents cesium-137 contamination based on logging measurements in the subsurface at the SX Tank Farm. A log of the cesium-137 contamination and sample locations are also shown.

A Tank Summary Data Report was prepared and published for each 100-series tank upon completion of the logging of the boreholes near the tank. These reports contained the log results along with summaries of geologic conditions, tank construction, operational history, tank contents, results of previous studies, and gross gamma log data that were acquired with low-resolution detectors for many years preceding the baseline characterization project.

After the Tank Summary Data Reports were completed for all the tanks in a tank farm, the findings were compiled in a Tank Farm Report. Tank Farm Reports also correlate subsurface geology and contamination from borehole to borehole and present three-dimensional subsurface contaminant plume visualizations created with commercially available geostatistical software. Tank Farm Reports have been published for each of the 12 tank farms at the Hanford Site.

Because spectral shape factor analysis and high-rate logging were implemented while the project was ongoing, some of the data from the earlier project phase were reanalyzed to locate occurrences of borehole-restricted sources, and some boreholes were re-logged with the high-rate system to obtain contaminant profiles from

highly contaminated zones that had "saturated" the original detectors. In addition, 88 boreholes were selected for repeat logging as many as 4 years after the initial baseline data were collected, primarily to check for possible contaminant movement over time. Several intervals of potential contaminant movement were observed.

After borehole-restricted contaminants were removed from the contaminant databases and high-rate and repeat logging results were added, the plume visualizations were revised. Amended plume visualizations and other observations were published in an addendum to each of the Tank Farm Reports.

"The baseline characterization project has made a significant contribution to the overall understanding of subsurface contamination related to the Hanford Tank Farms," said Joel Berwick, DOE–GJO Project Manager. "The baseline data are now being used to estimate contaminant inventories and to identify locations for further investigation," said Berwick. Early results suggesting that tank waste might have migrated significantly deeper than previously thought were validated by a DOE–RL independent review panel. The panel was commissioned to review work products and provide recommendations on the Hanford vadose zone. Results of the baseline characterization are available on the Internet at **http://www.gjo.doe.gov/programs/hanf/HTFVZ.html**.

Radionuclide Assessment System

In fiscal year 2000, the DOE Office of River Protection at Richland requested DOE–GJO to develop and manage a routine monitoring program for the Hanford Tank Farms. A logging system known as the radionuclide assessment system was designed to collect monitoring data by faster and simpler operations. This system utilizes three different sizes of sodium iodide detectors to measure gamma activity over a wide range.

In addition, DOE–GJO was requested to complete baseline logging of and prepare a report on the existing boreholes around the liquid waste discharge sites known as "cribs" and "ponds," located in the Hanford 200 East/West Areas adjacent to the tank farms. This ongoing project supports the site characterization and investigation activities being performed by DOE–RL.

For more information about DOE–GJO work at the Hanford Site, contact Don Metzler, current DOE–GJO Project Manager for the work at the Hanford Site, at (970) 248–7612.❖

Educational Outreach

Employee Participation Enriches Communities

U.S. Department of Energy Grand Junction Office (DOE–GJO) personnel and contractor employees have always been active in their local communities, and this fiscal year has been no exception. In addition to helping with charitable fund-raising events, employees also participated in several educational outreach activities.

Great American Teach-In

Last November, an employee with the DOE Pinellas Environmental Restoration Project in Largo, Florida, gave a presentation about his profession to his oldest son's third-grade class at the local school district's Great American Teach-In. "I entered the classroom wearing a full Tyvek suit, gloves, and a full-face respirator," said Barry Rice, Project Supervisor for DOE–GJO contractor MACTEC Environmental Restoration Services (ERS). "Obviously, the kids were really impressed with the suit. I had them guess what my job was and they actually came very close," said Rice. He used photographs to describe his profession and showed the students instruments he uses, such as a pH meter.

Rice also gave a basic explanation of environmental contamination. To simplify this broad subject, he used the example of cleaning up gasoline leaking from an underground storage tank. From the detailed nature of their questions, the students seemed to comprehend what Rice was saying and understand issues such as environmental impacts. One student was even able to explain how gasoline leaking from a tank into the subsurface could pollute the groundwater, causing people to be sick from drinking the water or their lawns to die from being irrigated with the contaminated water.

"My son told me that the class voted my presentation the best of the day," said Rice. Joe Daniel, another MACTEC–ERS employee, participated in the Teach-In with his daughter's third grade class at another school. Both employees said the experience was very satisfying and the thank you cards they received made the whole effort worthwhile.

Western Colorado Science Fair Spurs Young Scientists

The sweaty palms, the stuttering to say their names, the nervous gestures—is it test time again? No, these are all behaviors exhibited by the middle and high school students at the Western Colorado Science Fair that was held March 8 at Mesa State College in Grand Junction.

"You really feel for these kids who aren't used to talking to adults, whom they've never met, about their science projects," said Polly Krauland, a *WASTREN, Inc.,* employee, who volunteered as a judge in the senior finals round at the regional fair as well as at her daughter's local middle school science fair. "I have to give credit to those kids who did their own work without assistance from parents or other adults."

Educational Outreach

Katherine Krauland, daughter of Polly Krauland, a WASTREN, Inc., *employee at DOE–GJO, received the DOE–GJO junior science award certificate at the Western Colorado Science Fair.*

Ten DOE and contractor employees volunteered as judges at the fair. For the past several years, DOE–GJO has presented two special science award certificates —one in the junior division and one in the senior division—at the science fair awards ceremony. This year's winners were Katherine Krauland in the junior division, for her project titled "An Organic Alternative Source of Energy," and Ansel Staton in the senior division, for his project titled "The Relationship Between the Diameter and Efficiency of an Inertia Wheel."

Judges for the DOE special awards were looking for projects that represented original thought in the use of energy and demonstrated a clear understanding of the scientific method. Krauland's project proposed using organic materials (fruits and vegetables) to provide enough energy to run a clock. "She understood and could explain why electricity was being created," said Art Kleinrath, DOE–GJO Program Manager, and one of the judges for the science fair and the DOE special awards. "There was a clarity in her considerations for future application of natural electrolyte batteries," he said.

Staton's project featured a large inertia wheel to illustrate the design criteria for the storage and release of energy. His experiment examined the variation in use, storage, and retrieval of energy efficiencies relative to the placement of weight from the center of a flywheel. "The effectiveness of the presentation reflected the amount of consideration and research that went into this project," said Kleinrath. "The craftsmanship was top notch." Staton had systematically applied the scientific method to the design of the experiment, and he understood the practical use.

"Although neither of these students was selected to attend the state competition, they both demonstrated their potential to create viable alternative energy sources or uses," said Eben Greybourne, DOE–GJO Contract Specialist, and the other DOE special awards judge.

DOE Continues Giving Through S.E.E.D.S. Computer Donation Program

Since its first donation of excess computer equipment through the S.E.E.D.S. (Sharing Electronic Equipment District and Statewide) Program in the fall of 2000, DOE–GJO has coordinated numerous additional donations of equipment to the School District 51 Career Center in Grand Junction. Recently donated equipment included 115 central processing units, 136 monitors, 46 printers, 11 laptop computers, and a collection of other miscellaneous computer accessories.

U.S. Congressman Scott McInnis of Colorado established the S.E.E.D.S. Program in 1996 to provide a mechanism for the transfer of excess scientific and technological equipment to schools and educationally related nonprofit organizations.

The Career Center is a vocational school for District 51 high school students. Students in the Career Center learn how to repair and maintain computers by working on equipment donated by DOE and other entities. The refurbished equipment is then given to District 51 schools and to disadvantaged youth.

Children of DOE–GJO Employees Go "Back to the Future"

The Grand Junction, Colorado, area and the local DOE office have interesting histories. Children of DOE–GJO employees learned about the area's noteworthy past as well as some aspects of their parents' work at the site's annual "Take Our Children to Work Day" on April 25, 2002.

Sue Ball, Gretchen Davis, and Pete Steves (left to right), WASTREN, Inc.*, employees at DOE–GJO, join their grandchildren and children during the annual "Take Our Children to Work Day" at the Grand Junction Office.*

DOE–GJO expanded the national "Take Our Daughters to Work Day" to include sons of employees and almost 40 children of all ages visited the GJO site that day.

At one of the guided site tour stops, the Records Management lead for contactor *WASTREN, Inc.,* and a former DOE employee and resident historian related stories to the children about the GJO's past and some history on mining operations in the area. Other tour stops included a discussion about outdoor survival techniques, a presentation on the safety hazards associated with abandoned mines, and a visit by a U.S. Division of Wildlife biologist who enlightened the children about protection of endangered species.

DOE–GJO conducts remediation, reclamation, and long-term monitoring projects at sites across the country. "The actions we take at sites today can have positive or negative effects for many years," said Audrey Berry, DOE–GJO Public Affairs Specialist. "We wanted the children to realize the considerations, such as protecting wildlife and personal safety, that their parents make as they perform project activities in Grand Junction and in other parts of the country."

A colorful quilt sewn from pieces of fabric on which the children drew scenes depicting life in the Grand Valley hung in the main entrance to the site for all the visitors to admire. The contractor-sponsored safety committee purchased patriotic- and endangered species-themed items for the children and materials to make identification bracelets. The children also enjoyed a hot lunch at the site with their parents.

Educational Outreach

Radiological Assistance Program team members asked volunteers to don personal protection equipment (top) and explained the different types of monitoring equipment (center). Students observe a demonstration of the groundwater contamination model (bottom).

Enviro Fair

The Palisade High School (near Grand Junction) hosted its 11th annual Enviro Fair on April 11, 2002. Companies and organizations set up booths to show the high school students and visiting grade school students and community members how their organizations contribute to the environment. Contractor representatives from the U.S. Department of Energy Grand Junction Office (DOE–GJO) participated in this year's event and demonstrated the groundwater contamination model that was also used at the Ute Water Festival. "High school students are usually familiar with groundwater in general," said Wendee Ryan, Public Affairs Specialist for *WASTREN, Inc*. "We try to expand their knowledge by presenting how groundwater becomes contaminated, the implications for the water users, and some possible cleanup methods."

Two Radiological Assistance Program (RAP) team members from GJO demonstrated the RAP trailer, equipment, and capabilities. They asked student volunteers to don personal protective equipment used in radiological emergency responses and presented the team members' responsibilities during a response. "While there are other entities at the scene that handle certain aspects of the emergency, we are there specifically to address the radiological aspect," said Dan Dow, DOE–GJO RAP team member. The RAP team members also showed the students the various types of monitoring instruments, air sampling equipment, communications equipment, and other emergency response devices.

Kids Get Wet and Wild at Water Festival

Each spring, more than 1,500 fifth grade students from Grand Junction and surrounding areas participate in the Ute Water Festival—2 days filled with discoveries about water. The Ute Water Conservancy District is the primary sponsor of this event and it partners with other local businesses and government agencies to provide a diverse collection of hands-on activities to help educate the students on the importance of water in our world.

This is the third year that representatives from MACTEC–ERS participated in the event that was hosted by Mesa State College in May. Representatives used a sand-tank model to demonstrate groundwater movement. The model includes a simulated confined aquifer, an artesian well, a pumping well and other wells, a leaky landfill, and a lake. Demonstrators "recharged" the water system of the model with distilled water and inserted food coloring into the various wells to allow the students to track the movement of the groundwater. Some of the topics discussed as part of the demonstration included how groundwater becomes contaminated, characterization techniques used to gather information about the kind of contamination, and cleanup strategies, such as pump-and-treat and natural flushing methods.

The students are usually assigned a role, for example, hydrogeologist, sampler, or polluter, and play an active part in the groundwater demonstration. Students were asked to examine the groundwater flow carefully to determine which well they could use to extract the most contamination (colored water) with plastic syringes.❖

GJO Prepares for Busy Summer (continued from page 15)

An addendum to the Remedial Investigation report for Monticello surface water and groundwater is now being prepared to document the results of the interim remedial action and the nature and extent of the surface water and groundwater contamination. The addendum, scheduled to be completed in spring 2003, will also update the current and future risks to human health and the environment. A Feasibility Study will be prepared that will identify and evaluate remediation alternatives for the contaminated surface water and groundwater.

Other Projects

Also included in this edition of the *Grand Junction Office Perspective* are updates on several Uranium Mill Tailings Remedial Action (UMTRA) Ground Water Project sites, the status of our long-term stewardship pilot projects, some interesting technical exchanges we hosted, the completion of a Hanford Tank Farm baseline characterization project, and educational outreach activities.

Donna Bergman-Tabbert, Manager
U.S. Department of Energy Grand Junction Office

RAP Team Assists FBI at 2002 Winter Olympics

Daryl Hillyer, a WASTREN, Inc.*, subcontractor employee and a member of the DOE Radiological Assistance Program Region 6 team, provided radiological assistance at the 2002 Winter Olympics.*

More than 25 federal, state, and local agencies were involved in security and safety tasks at the recent 2002 Winter Olympic Games in Salt Lake City, Utah.

The U.S. Department of Energy Grand Junction Office (DOE–GJO) Radiological Assistance Program (RAP) team provided technical support to the games from January 18 through February 25. The DOE–GJO RAP team had one to two team members a week in the Salt Lake City area representing RAP Region 6. DOE RAP Region 6 furnished radiological assistance to the lead federal agency, the Federal Bureau of Investigation.

The RAP team members offered expertise in use of radiological equipment and taking radiological measurements. The duties of the RAP team members were to conduct radiological surveys of personnel and property, sample for airborne contamination, monitor radiological equipment, and assist in the decontamination of equipment and personnel as needed.

For more information about the DOE–GJO RAP team, visit our website at **www.gjo.doe.gov/rap/**, or contact Jon Sink, DOE–GJO RAP Coordinator, at (970) 248–6016.❖

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